Loch Braìgh Horrisdale to Sidhean Mòr

[NG 788 699]–[NG 811 721]

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Introduction

This GCR site provides a cross-section through Archaean gneisses and mafic dykes of the Scourie Dyke Suite that form part of the Southern Region, immediately south-west of the outcrop of the Loch Maree Group. The site lies *c.* 4.4–7.4 km south of Gairloch and provides a complete, well-exposed, traverse across the south-west side of the regional Gairloch Shear Zone (Figure 3.1). It demonstrates the relationships between Badcallian, Inverian and Laxfordian structures and the Scourie dykes, thus enabling the sequence of tectonothermal events in this part of the Lewisian Gneiss Complex to be deduced.

Badcallian gneisses are unmodified to the south-west of Loch Braìgh Horrisdale, but northeast of the loch they are affected by Inverian deformation, resulting in intense folding and a steep axial-plane foliation. Both the Badcallian and the Inverian structures and fabrics are crosscut by the later Scourie mafic dykes. In the south-west part of the site Laxfordian deformation is manifest only as scattered discrete narrow shear-zones affecting the mafic dyke margins, but deformation increases progressively northeastwards, resulting in the superimposition of a generally pervasive Laxfordian planar fabric in the mafic dykes and recrystallization of the gneisses. This change in intensity of Laxfordian deformation marks the transitional southwestern margin of the Gairloch Shear Zone. C.T. Clough and W Gunn originally mapped the area for the Geological Survey in 1889, and it was described by Peach *et al.* (1907). It has been been remapped recently by the author (see Park, 2002).

Description

The Loch Braìgh Horrisdale to Sidhean Mòr site lies south of Shieldaig and occupies an oblong area *c.* 3.2 km x 1 km with its long dimension trending north-east. It consists of glacially scoured rocky gneiss outcrops that lie at *c.* 100 m above OD around Loch Braìgh Horrisdale, but form higher knolls to the north-east at *c.* 150–180 m above OD, culminating in Sidhean Mòr (225 m). Numerous lochs, gullies and small stream valleys are present. The Lewisian rocks lie just beneath the Torridonian unconformity with patches of the overlying Applecross Sandstone Formation impinging on the site area (Figure 3.27).

Based on the degree of tectonic reworking, the GCR site can be divided into three areas: south-western, central and north-eastern (Figure 3.27). The south-western area, west of Loch Braìgh Horrisdale and the Badachro River, lies within the northern part of the Badcallian enclave of An Ruadh Mheallan [NG 835 615] (see also Alligin (Diabaig) GCR site report, this chapter). Here centimetre- to metre-scale banded dominantly felsic (granodioritic) gneisses display Badcallian structure, and the banding/foliation trends generally north and dips moderately to steeply to the west. These coarse-grained Archaean gneisses are cut by sparse, narrow, Inverian shear-zones with a steep NW-trending foliation, and by NW-trending Scourie dykes, which are mostly undeformed, but a few show evidence of shearing in narrow marginal zones. The relationships between the Scourie dykes and the Badcallian banding are best displayed on the crags of Meallain an Uillt-ghiubhais [NG 790 700] (Figure 3.27). The dykes here are clearly discordant to the gneissose banding. A thicker dyke on the north-east side of this hill is undeformed, but several thinner dykes farther to the south-west contain narrow marginal shear-zones. The orientation of the fabric in these shear zones implies a sinistral, oblique (south-side-up) sense of shear has occurred.

The central part of the site extends from the north-east shore of Loch Braìgh Horrisdale to a small stream (Allt na Glaic–Sieldaig) that flows north-westwards from the un-named loch immediately south of Sidhean Mòr. The geology is best examined by making a traverse northeastwards from Loch Braìgh Horrisdale. On the crags immediately north of the track at [NG 803 708], a 50 m-wide amphibolite dyke displaying only marginal deformation cuts banded felsic gneisses;

the gneisses display typical Inverian open to tight folding with steep NW-trending axial planes and foliation. The Inverian structures are clearly cross-cut by the dyke margin, showing that they pre-date mafic dyke emplacement. From here north-eastwards to the Allt na Glaic–Sieldaig, NW-trending structures of Inverian age are ubiquitous. There are many thin dykes, typically deformed only in marginal shear-zones. The sense of shear on these thin zones is again sinistral, south-up, and locally a faint, steeply SE-plunging intersection lineation may be observed.

There is an unusually high concentration of mafic dykes of the Scourie Dyke Suite in both the central and northern parts of the GCR site, where the dykes make up about one-third of the outcrop, the highest concentration seen anywhere in the Lewisian Gneiss Complex. Although up to 100 m wide, there are numerous smaller dykes between 1 m and 10 m wide. The dykes often form branching networks, and many of the thin dykes probably join at depth (Park, 2002).

In the north-eastern area, from Allt na Glaic–Sieldaig to Sidhean Mòr., the effects of Laxfordian deformation become much more apparent. Most Scourie dykes are penetratively deformed and the felsic gneisses between the dykes also show evidence of the superimposition of a strong Laxfordian fabric. They are recrystallized to a finer grain-size and exhibit a marked grain-aggregate shape fabric, which shows a pronounced linear element with a moderate plunge to the south-east. Some of the coarser-grained dykes possess deformed felsic grain aggregates that have been used as strain markers; these also have a linear element plunging to the south-east. The prominent rocky ridge of Sidhean Mòr [NG 812 716] is formed by a *c.* 100 m-wide dyke, which forms part of a branching dyke system that extends down the north-east slopes of the hill. Parts of this dyke system are still undeformed and exhibit chilled margins against the host gneisses (Figure 3.28), even though thinner Scourie dykes to the southwest are foliated throughout.

Interpretation

From the traverse described above, it is clear that there is a transitional south-western boundary to the major zone of Laxfordian deformation that occupies the Gairloch area. It is marked mainly by the development of penetrative Laxfordian planar and linear fabrics in the felsic gneisses, rather than by any abrupt change in the state of deformation of the dykes. The Laxfordian foliation trends north-west and dips steeply and the lineation plunges south-east. They were developed under amphibolite-facies conditions, which characterize the early-Laxfordian phase of deformation in the Gairloch Shear Zone. This Laxfordian deformation is superimposed upon the earlier NW-trending, steeply dipping, Inverian foliation, which can be seen affecting the N-trending Badcallian gneisses in the southern part of the site. Both the Inverian and Badcallian gneisses also contain amphibolite-facies assemblages and show no evidence of an earlier granulite-facies event. The south-west margin of the main zone of Inverian deformation lies about 1 km south-west of the main Laxfordian shear-zone, although localized Laxfordian effects are present throughout the site. The sense of movement on the narrow localized Laxfordian shears is typically sinistral, oblique, south-side-up, in contrast to that of the main Gairloch Shear Zone, which is dextral, oblique, north-side-up.

The unusually high concentration of Scourie dykes in this area, making up about one-third of the outcrop area, might suggest proximity to an early Palaeoproterozoic rift approximately coincident with the Loch Maree Group outcrop (see Johnson *et* al., 1987).

Conclusions

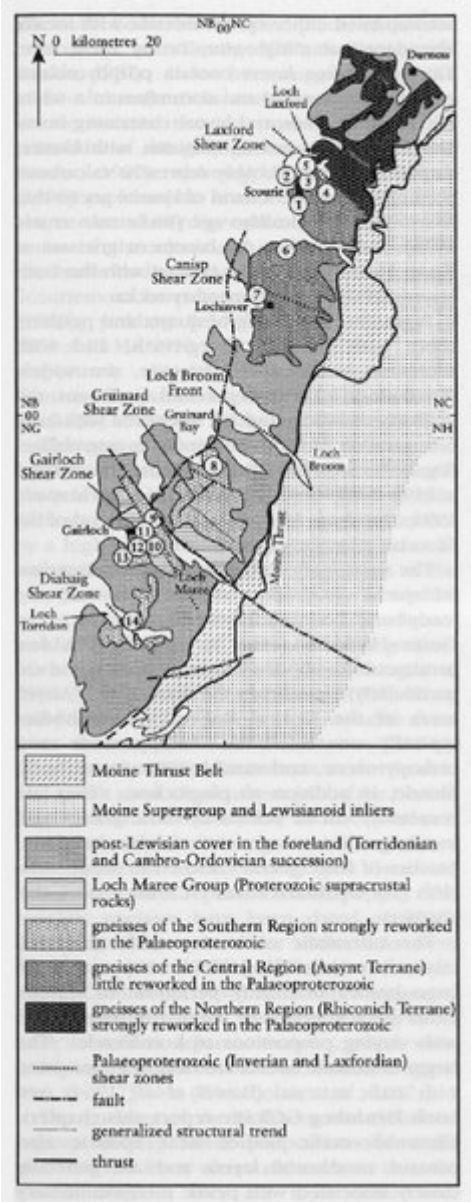
The Loch Braìgh Horrisdale to Sidhean Mòr site provides a near-continuous 3 km-long traverse across the south-west margin of the regional Laxfordian Gairloch Shear Zone. A series of excellent exposures clearly demonstrate the following features:

- In the south-western part of the site, undeformed Scourie dykes cross-cut Badcallian banded gneisses that exhibit N-trending structures.
- In the central part of the site, the Badcallian gneissic banding is folded, and affected by steep NW-trending Inverian foliation; the dykes are subconcordant to this foliation but locally cross-cut it, thus establishing the pre-dyke age of the Inverian structure.

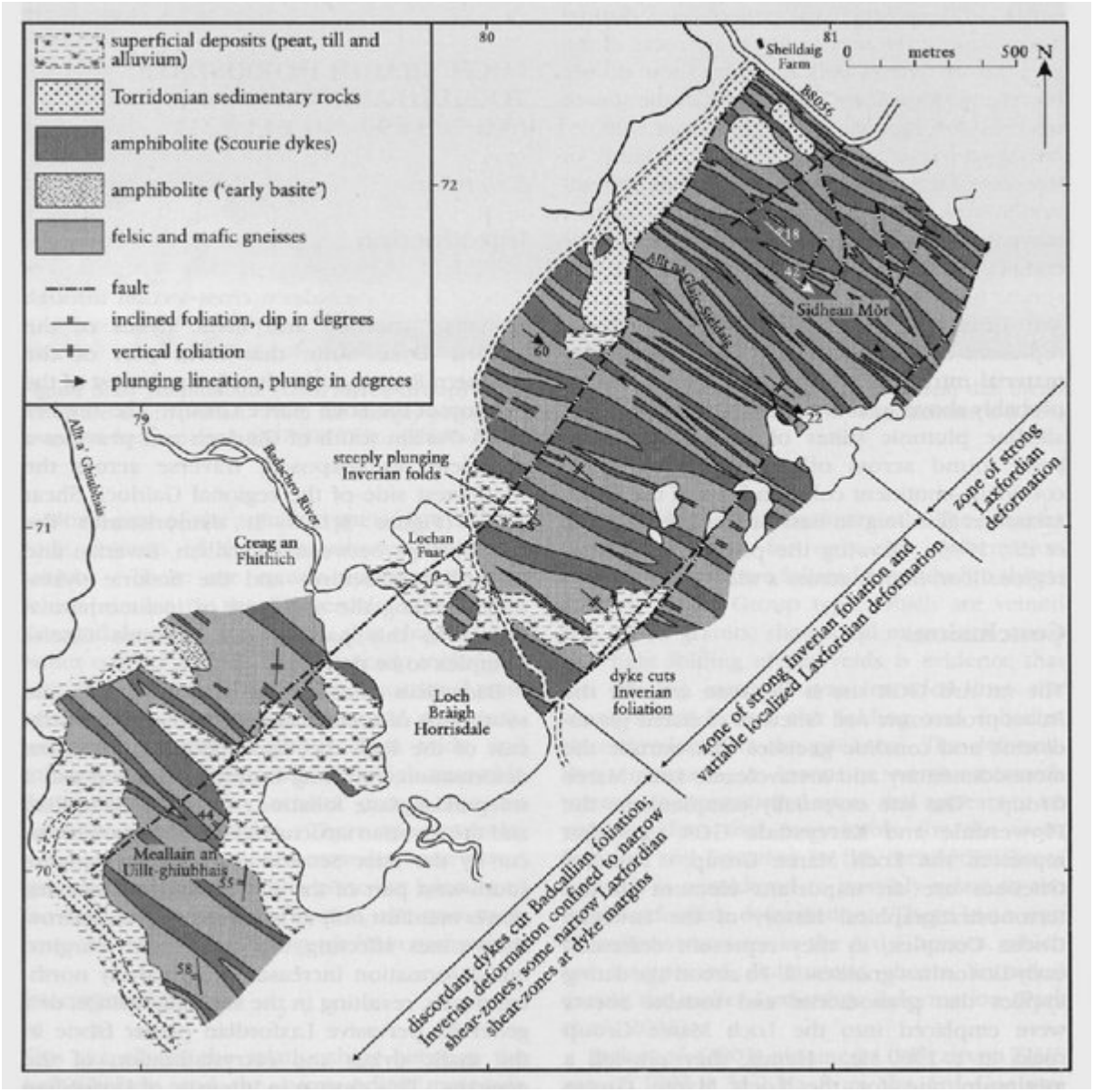
- In both the south-western and central areas, narrow Laxfordian shear-zones are common; they affect the margins of the dykes and typically have a sinistral, oblique, south-side-up sense of shear.
- In the north-eastern part of the site, Laxfordian deformation is more widespread; although its effects are still variable in the dykes, in the gneisses a pervasive new fabric and SE-plunging lineation are developed.

These four observations help to reconstruct the sequence of Palaeoproterozoic events in the Southern Region of the Lewisian Gneiss Complex, and improve the understanding of the geometry and kinematics of the Gairloch Shear Zone. The site is of national importance in that it is one of the few places where the sequence of events involved in the Palaeoproterozoic reworking of the Archaean gneiss complex can be readily demonstrated.

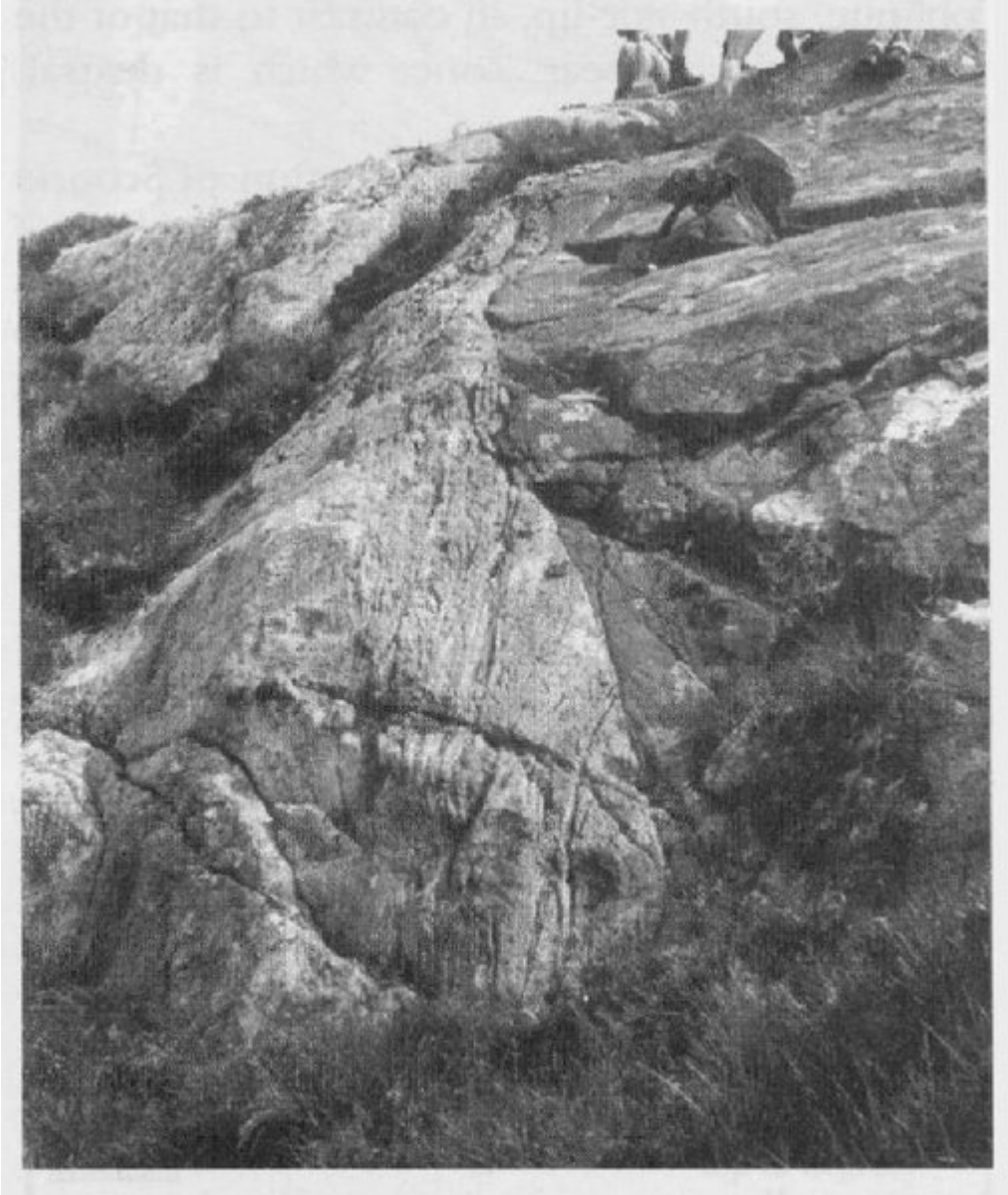
References



(Figure 3.1) Simplified map of the Lewisian Gneiss Complex of mainland Scotland. GCR sites: 1— Badcall; 2 — Scourie Mor; 3 — Sìthean Mar; 4 — Scourie Bay; 5 — Tarbet to Rubha Ruadh; 6 — Loch Drumbeg; 7 — An Fharaid Mhòr to Clachtoll; 8 — Gruinard River; 9 — Creag Mhor Thollaidh; 10 — Kerrysdale; 11 — Flowerdale; 12 — An Ard; 13 — Loch Braigh Horrisdale to Sidhean Mòr; 14 — Alligin (Diabaig). After Park and Tarney (1987).



(Figure 3.27) Map of the area between Loch Braigh Horrisdale and Sidhean Mòr After Park (2002).



(Figure 3.28) Undeformed Scourie dyke cutting steeply dipping Inverian foliation on the north-east slopes of Sidhean Mòr (Photo: R.G. Park.)